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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte CHARLES DELACOURT, PHILIPPE POIZOT, and
CHRISTIAN MASQUELIER

Appeal 2015-007222
Application 11/993,925
Technology Center 1700

Before CHUNG K. PAK, JEFFREY T. SMITH, and
WESLEY B. DERRICK, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants¹ appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 26 through 28, 30 and 31.² We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ Appellants identify the Real Party in Interest as Umicore. (Appeal Brief filed February 27, 2015 ("App. Br."), 5.)

² Final Office Action entered May 22, 2014 ("Final Act.").

STATEMENT OF THE CASE

The subject matter on appeal is generally directed to a carbon-free crystalline LiFePO_4 powder having an average particle size below 200 nm and a particle size distribution ratio $((d_{90}-d_{10})/d_{50})$ of less than 0.8. (Spec. 4, l. 29–5, l. 2; 6, ll. 18–19.) The particle size distribution ratio reflects a narrow particle size distribution which is said to “facilitate[] the electrode manufacturing process and ensure[] a homogeneous current distribution within the battery.” (Abstract; Spec. 6, ll. 17–18.)

Details of the appealed subject matter are recited in representative claim 26, which is reproduced below from the Claims Appendix to the Appeal Brief:

26. A carbon-free crystalline LiFePO_4 powder having a particle size distribution with an average particle size d_{50} below 200 nm, wherein the particle size distribution ratio $(d_{90}-d_{10})/d_{50}$ is less than 0.8.

(App. Br. 37, Claims Appendix.)

Appellants seek review of the following grounds of rejection maintained by the Examiner in the Answer entered on June 1, 2015 (“Ans.”):

Claims 26–28, 30, and 31 under 35 U.S.C. § 103(a) as unpatentable over the disclosure of Scaccia, et al., *Morphological Investigation of Sub-micron FePO_4 and LiFePO_4 Particles for Rechargeable Lithium Batteries*, 38 Materials Research Bulletin 1155 (2003) (hereinafter referred to as “Scaccia”) in view of U.S. patent application publication 2007/0054187 A1, published in the name of Nuspl et al. on March 8, 2007 (hereinafter referred to as “Nuspl”); and

Claims 26–28, 30, and 31 under 35 U.S.C. § 103(a) as unpatentable over the disclosure of an English translation of Italian patent 0001323621, issued in the name of Prosini et al. on July 31, 2001 (hereinafter referred to as “Prosini”)³ in view of Nuspl.

DISCUSSION

Upon consideration of the evidence on this appeal record and each of Appellants’ contentions, we determine that a preponderance of the evidence supports the Examiner’s determination that the collective teachings of Scaccia and Nuspl would have rendered the subject matter recited in claims 26–28, 30, and 31 obvious to one of ordinary skill in the art at the time of the invention within the meaning of 35 U.S.C. § 103(a). Accordingly, we affirm this rejection for the reasons set forth in the Final Action and the Answer.⁴ We add the following primarily for emphasis and completeness.

³ Appellants do not contest the Examiner’s reliance on the English translation of the Italian patent.

⁴ Having affirmed the rejection of all the claims on appeal based on the combined teachings of Scaccia and Nuspl, it is unnecessary for us to address the cumulative § 103(a) rejection based on the combined teachings of Prosini and Nuspl maintained by the Examiner. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (holding that obviousness rejections need not be reached upon affirming a rejection of all claims as anticipated); *In re Basell Poliolefine*, 547 F.3d 1371, 1379 (Fed. Cir. 2008) (“Having concluded that the Board properly affirmed the rejection of claims 1–52 of the ‘687 patent based on obviousness-type double patenting in view of the ‘987 patent, we need not address the remaining issues raised by Basell regarding the §§102(b) and 103(a) rejections, as well as the additional double patenting rejections. Accordingly, the Board’s decision is affirmed.”); *Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (having decided a single

Claim 26

The Examiner finds that Scaccia discloses heating amorphous LiFePO_4 particles at 550°C to form crystalline particles having a mean particle size of below 200 nm. (Ans. 6.) Appellants do not dispute the Examiner's finding that Scaccia does not disclose that the crystalline LiFePO_4 particles comprise carbon or that carbon is used during production of the particles. (*Compare* Ans. 6, *with* App. Br. 11–16.) Based upon this undisputed finding, the Examiner determines that the crystalline LiFePO_4 particles disclosed in Scaccia are carbon-free. (Ans. 6.) Appellants also do not dispute the Examiner's finding that Scaccia discloses that obtaining a homogenous, finer LiFePO_4 powder is beneficial in applications in which the LiFePO_4 powder is used as an electrode material in secondary batteries. (*Compare* Ans. 2, *with* App. Br. 11–16.) The Examiner acknowledges that Scaccia does not explicitly disclose a particle size distribution ratio (d_{90} - d_{10}/d_{50}) of less than 0.8 for the LiFePO_4 particles, and relies on Nuspl for this disclosure. (Ans. 3.)

Specifically, the Examiner finds that Nuspl discloses that very small LiFePO_4 particles having a very narrow size distribution are particularly useful as an electrode material for secondary batteries due to their very good electrochemical properties, which Appellants do not dispute. (*Compare* Ans. 6, *with* App. Br. 11–16.) Appellants also do not dispute the Examiner's finding that Nuspl discloses that large LiFePO_4 particles lead to a significant decrease in the specific capacity of storage batteries at high charge/discharge

dispositive issue, the ITC was not required to review other matters decided by the presiding officer).

currents, and negatively influence the electrochemical properties of secondary batteries. (*Compare* Ans. 9–10, with App. Br. 11–16.) The Examiner finds that Nuspl's disclosure that particle size and particle size distribution affect the electrochemical properties of secondary batteries demonstrates that particle size and particle size distribution are result-effective variables. (Ans. 9–10.

The Examiner further finds that Nuspl discloses LiFePO_4 particles having a mono-modal, narrow particle size distribution in which d50 (average particle size) is no more than 500 nm (inclusive less than 200 nm), and the difference between d90 and d10 is less than 500 nm (inclusive of less than 200 nm), which includes a $(d90-d10)/d50$ value of less than 1, overlapping the particle size and particle size distribution ranges recited in claim 26. (Ans. 6–7.) Based on these findings, the Examiner concludes that the collective teachings of Scaccia and Nuspl would have led one of ordinary skill in the art to optimize the size and the size distribution of the LiFePO_4 particles disclosed in Scaccia through nothing more than routine optimization to produce particles having an average particle size less than 200 nm and a very narrow size distribution, such as a $(d90-d10)/d50$ value of less than 0.8, as recited in claim 26, with a reasonable expectation of successfully obtaining LiFePO_4 particles having very good electrochemical properties, as disclosed by Nuspl. (Ans. 7.)

Appellants argue that neither Scaccia nor Nuspel discloses LiFePO_4 particles having an average particle size (d50) below 200 nm and a particle size distribution ratio $((d90-d10)/d50)$ of less than 0.8. (App. Br. 12–14.)

However, Scaccia discloses crystalline LiFePO_4 particles having a mean particle size of below 200 nm, which were produced by crystallizing amorphous LiFePO_4 particles at 550°C that were prepared by aqueous precipitation. (Scaccia 1156–1157, 1162, Fig. 6.) Scaccia further discloses that small, homogeneous LiFePO_4 particles are beneficial for use as cathode (electrode) materials for rechargeable lithium batteries, and discloses that precipitation methods for preparing cathode materials, which provide intimate mixing of the component elements in solution, result in finer, homogeneous particles. (Scaccia 1156.) Scaccia's disclosures thus implicitly indicate that the crystalline LiFePO_4 particles having a mean particle size of below 200 nm were homogeneous, thus suggesting the narrow particle size distribution reflected in the particle size distribution ratio recited in claim 26.

In addition, Nuspl discloses LiFePO_4 particles for use in secondary batteries that exhibit excellent electrochemical properties and preferably have an average particle size (d_{50}) of less than 500 nm, inclusive of less than 200 nm, and have a very narrow, substantially mono-modal particle size distribution in which the difference between d_{90} and d_{10} is preferably no more than 500 nm (inclusive of less than 200 nm), resulting in a particle size distribution ratio $((d_{90}-d_{10})/d_{50})$ of less than 1. (Nuspl ¶¶ 1, 7, 44, 45.) Therefore, both the average size (d_{50}) and size distribution ratio $((d_{90}-d_{10})/d_{50})$ of the LiFePO_4 particles disclosed in Nuspl encompass the respective ranges recited in claim 26, rendering the recited ranges *prima facie* obvious. *In re Peterson*, 315 F.3d 1325, 1329–330 (Fed. Cir. 2003) (“In cases involving overlapping ranges, we and our predecessor court have

consistently held that even a slight overlap in range establishes a prima facie case of obviousness . . .”).

Moreover, we agree with the Examiner’s finding that Nuspl’s disclosure that the electrochemical properties of secondary batteries are affected by the size and size distribution of LiFePO_4 particles used as cathode material in batteries demonstrates that LiFePO_4 particle size and particle size distribution are result-effective variables. (Ans. 9–10; Nuspl ¶¶ 42, 58.) *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) (“A recognition in the prior art that a property [or a result] is affected by the variable is sufficient to find the variable result-effective.”) Accordingly, one of ordinary skill in the art at the time of the invention seeking to produce LiFePO_4 particles having excellent electrochemical properties as disclosed by Nuspl would have been led to arrive at the size and size distribution of LiFePO_4 particles recited in claim 26 through nothing more than routine optimization of the size and size distribution of LiFePO_4 particles taught by Scaccia. *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980) (“[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.”); *Peterson*, 315 F.3d at 1329–330.

Appellants argue that modifying the solid precursor particles disclosed in Scaccia with a dispersion treatment as disclosed in Nuspl would not affect the particle size distribution of Scaccia’s end-product, and would therefore not result in Scaccia’s particles having a size distribution ratio as recited in claim 26. (App. Br. 14–16.) Appellants contend that the combined disclosures of Scaccia and Nuspl therefore do not enable one of ordinary skill in the art to make crystalline LiFePO_4 powder having an average

particle size (d50) below 200 nm and a particle size distribution ratio (d90-d10)/d50 of less than 0.8. (App. Br. 21–23.) In support of these arguments, Appellants rely on the declaration of Eric Robert, which was submitted to the Patent Office on April 8, 2014 (“the Robert Declaration”). (App. Br. 14–16, 21–23.)

However, these arguments are not persuasive of reversible error. First, “a non-enabling reference may qualify as prior art for the purpose of determining obviousness under § 103.” *Symbol Techs., Inc. v. Opticon, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991). Secondly, Appellants’ unsupported arguments and the unsupported statements in the Robert Declaration do not demonstrate that one of ordinary skill in the art could not have arrived at the LiFePO₄ powder recited in claim 26 without undue experimentation based on the disclosures of Scaccia and Nuspl, together with information known in the art, at the time of the invention. (App. Br. 14–16, 21–23.) *In re Antor Media Corp.*, 689 F.3d 1282, 1288 (Fed. Cir. 2012) (A prior art printed publication, like a prior art patent, “is presumptively enabling barring any showing to the contrary by a patent applicant or patentee.”); *In re Morsa*, 713 F.3d 104, 110 (Fed. Cir. 2013) (“[A]n applicant must generally do more than state an unsupported belief that a reference is not enabling.”). Specifically, on this record, Appellants do not proffer sufficient reasoning (e.g., the reasoning based on the factors listed in *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)) or evidence to demonstrate that one of ordinary skill in the art could not have used the aqueous precipitation process described in Scaccia (Scaccia 1156–1157) under appropriate conditions with or without known particle screening or separating means, or the aqueous precipitation process disclosed in Nuspl (Nuspl ¶ 19) under appropriate conditions, with

or without known particle screening or separating means to form LiFePO_4 powder having an average particle size (d_{50}) below 200 nm and a particle size distribution ratio ($d_{90}-d_{10}$)/ d_{50} of less than 0.8, without undue experimentation. (App. Br. 14–16, 21–23; Robert Declaration ¶¶ 8–10, 13–15.) As discussed above, the disclosures of Scaccia and Nuspl would have suggested LiFePO_4 particles having the size and size distribution ratio recited in claim 26, and one of ordinary skill in the art would have been led to form LiFePO_4 particles of such size and size distribution ratio by the process of either reference, with a reasonable expectation of successfully forming such LiFePO_4 particles having the recited average particle size and narrow particle size distribution that would have beneficial electrochemical properties. In this regard, it is important to recognize that both Scaccia and Nuspl disclose forming LiFePO_4 powder having a particle size inclusive of those claimed, with either a homogeneous particle size distribution or a particle size distribution ratio of less than 1 as indicated *supra*. Appellants do not proffer any basis or evidence to question the accuracy or veracity of the statements in either Scaccia or Nuspl.

Appellants further argue that particle size distribution is not a result effective variable due to “the amount of effort without success that went into trying to achieve a LiFePO_4 powder comprising particles having the combination of nanometer sized particles and narrow particle size distribution,” as described in the background section of their Specification. (App. Br. 21.) However, we find this argument lacking in persuasive merit because, as discussed above, Nuspl discloses that the size distribution of LiFePO_4 particles used as cathode material in secondary batteries affects the electrochemical properties of the batteries, which demonstrates that LiFePO_4

particle size distribution is a result-effective variable. (Nuspl ¶¶ 42, 58.) *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) (“A recognition in the prior art that a property [or a result] is affected by the variable is sufficient to find the variable result-effective.”). In any event, as indicated *supra*, both the average size (d50) and size distribution ratio ((d90-d10)/d50) of the LiFePO₄ particles disclosed in Nuspl also encompass or overlap with the respective ranges recited in claim 26, thus rendering the recited ranges *prima facie* obvious. *Peterson*, 315 F.3d at 1329–330.

Appellants “may overcome a *prima facie* case of obviousness by establishing ‘that the [claimed] range is critical, generally by showing the claimed range achieves unexpected results relative to the prior art range,’” which “standard applies when . . . the applicant seeks to optimize certain variables by selecting narrow ranges from broader ranges disclosed in the prior art.” *Peterson*, 315 F.3d at 1330-31. On this record, however, Appellants do not argue or demonstrate that the recited ranges impart unexpected results. (App. Br. 11–16.)

We accordingly sustain the Examiner’s rejection of claim 26 under 35 U.S.C. § 103(a).

Claim 28

Claim 28 depends from claim 26 and requires the LiFePO₄ powder to have a maximum particle size below 500 nm. Appellants argue that Scaccia discloses that the size of crystalline LiFePO₄ particles increases with crystallization temperature, and Appellants further argue that Scaccia discloses that particles crystallized at 750° C were variable in size, with some being a few microns and others being 500–1000 nm. (App. Br. 17, 23.) However, as discussed above, Scaccia teaches or impliedly teaches that

LiFePO₄ particles crystallized at 550°C, rather than 750°C, had a mean particle size below 200 nm, and had a homogeneous particle size distribution, which would have suggested forming the particles having particles sizes near 200 nm, i.e., below 500 nm. Moreover, as also indicated above, Nuspl discloses forming LiFePO₄ powder having a preferred particle size of less than 500 nm, with a particle size distribution ratio inclusive of that recited in claims 26 and 28. Appellants' arguments are therefore unpersuasive of reversible error, and we accordingly sustain the Examiner's rejection of claim 28 under 35 U.S.C. § 103(a).

Claims 27, 30, and 31

Although Appellants separately argue claims 27, 30, and 31, Appellants do not provide substantive arguments as to the separate patentability of these claims, and essentially repeat their contentions that the Examiner erred in rejection claim 26, from which claims 27, 30, and 31 depend. (App. Br.16–18, 23–24.) 37 C.F.R. § 41.37(c)(1)(iv) (“A statement which merely points out what a claim recites will not be considered an argument for separate patentability of the claim”); *In re Lovin*, 652 F.3d 1349, 1357 (Fed. Cir. 2011) (“[T]he Board reasonably interpreted Rule 41.37 to require more substantive arguments in an appeal brief than a mere recitation of the claim elements and a naked assertion that the corresponding elements were not found in the prior art. Because Lovin did not provide such arguments, the Board did not err in refusing to separately address claims 2–15, 17–24, and 31–34.”). Because we are unpersuaded of reversible error in the Examiner's rejection of claim 26 as discussed above, Appellants' position as to the rejection of claims 27, 30, and 31 is equally

without merit. Accordingly, we sustain the rejection of claims 27, 30, and 31 under 35 U.S.C. § 103(a).

ORDER

In view of the reasons set forth above and in the Final Action and the Answer, we affirm the Examiner's decision rejecting claims 26–28, 30, and 31 under § 103(a).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED